

Physics 31a: Quantum Theory I

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Time & place: Monday, Wednesday, Thursday, 12:00 - 12:50 in Abelson 239

Course content: Quantum mechanics is arguably the most revolutionary theory in physics since Newton. It requires us to dramatically change how we think about the world, and to learn a new mathematical language to describe and make predictions about physical systems. This course will cover the physics and mathematics required to understand quantum mechanics, as well as their application to a few key systems. Along the way, we will also practice certain skills that are useful throughout physics and beyond (such as dimensional analysis and the use of *Mathematica*), and discuss the historical discovery of quantum mechanics. We will follow rather closely Griffiths' book *Introduction to Quantum Mechanics* (second edition), covering the material in the first four chapters and the appendix.

Reading: There will be a reading assigned for each Monday, mostly from Griffiths but sometimes with supplementary material. The material in a physics textbook—even a good one like Griffiths—does not flow easily from page to brain. Therefore you must read actively: with pencil and paper at hand, reproducing all derivations for yourself. I also recommend that you take notes on the reading, for a reason that will be clear below.

We will be using a lot of math in this course: complex numbers, Fourier series and transforms, probabilities, ordinary and partial differential equations, special functions, and linear algebra. For this material, I will often suggest readings from the book *Mathematical Methods in the Physical Sciences* by Boas (third edition). I recommend owning a copy; it will serve you well not just in this course but in all your future physics and math courses as well. Coming into the course, you should be pretty comfortable with most of the material in the first 6 chapters. (If you don't have a copy, take a look at the table of contents on Amazon, for example.)

Class time: Class time will be spent partly with lectures aimed at summarizing, clarifying, and supplementing the material in Griffiths, and partly with exercises and discussions to help you learn that material. When working on those exercises, or when I call on you, **you will not be allowed to consult the book**; however, you will be allowed to consult your notes!

Two more rules for class time: No eating (drinking is okay) and no laptops please.

Problem sets: There will also be a problem set due each Monday, which will include both relatively easy exercises from the reading and more challenging problems on the material in the previous week's unit. You are expected to collaborate with each other, but you should write up the problem set on your own. The best algorithm for doing a physics problem set is:

1. attack each problem by yourself, working on it until you either solve it or get stuck;
2. get together with a group of your colleagues, to check your answers to the problems you've solved and figure out the ones you haven't;
3. working by yourself again, carefully write up your solutions (this will convince you that you fully understand the solution).

Please provide complete, clear solutions, written neatly, in correct English, on clean paper. I will deduct points both for unclear reasoning and for sloppy presentation. Homeworks handed in late, but no later than the next class meeting, will be graded with a 50% discount; later homeworks will not be accepted.

Exams: There will be a 50-minute in-class midterm on March 7, and a 3-hour in-class final exam.

Grades: In computing your grade for the course, the different components will be weighted as follows:

- 50% for the homeworks
- 10% for the midterm
- 40% for the final exam.

Announcements & questions: In order to maximize the class time available for us to discuss physics, we will use the forum on Latte called “Course News & Announcements” for announcements and questions about the mechanics of the course (assignments, exams, grades, etc.). (Confidential questions, of course, may be e-mailed to me or asked in person.) You are automatically subscribed to this forum at the beginning of the semester.

Physics questions are welcome at any time, both in class and out. I have set up a forum on Latte for physics questions, including ones relating to the homeworks. I will try to answer your questions on this forum as quickly as possible, but students should also feel free to answer each others' questions.

Office hours: I will be in my office most of the day on most weekdays. You are welcome to knock on my door, and I will meet with you if I can. Alternatively, send me an e-mail to set up an appointment.